The Way Ahead in Game-Based Learning

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Overview

- Background

- A Case for Game-Based Learning

    - Science of Learning

- Developing Game-Based Learning

- Challenges & Issues

- Example

- The Way Ahead

Background

- **Popularity of Video Games**

  - > $10 Billion Industry yearly
  - Top game budgets exceed $50 Million

    - GTA IV is estimated at $100 Million

  - Maple Story has > 50 Million registered players!

  - Second Life has > 3 million residents

- Demographics

  - "Digital Natives"

Background

BUT, serious games are:

- Mostly Hype…NOT science
- Lack of guidelines

| *World of Warcraft* Blizzard Games | *Civilization 4* 2K Games | *Second Life* Linden Labs | *SimCity 4* EA Maxis |

Opportunity to exploit technology is tremendous!

Background

- ## Definitions:
  - ### Game
  - ### Serious game
- ## Simulation *vs* Virtual World *vs* Game

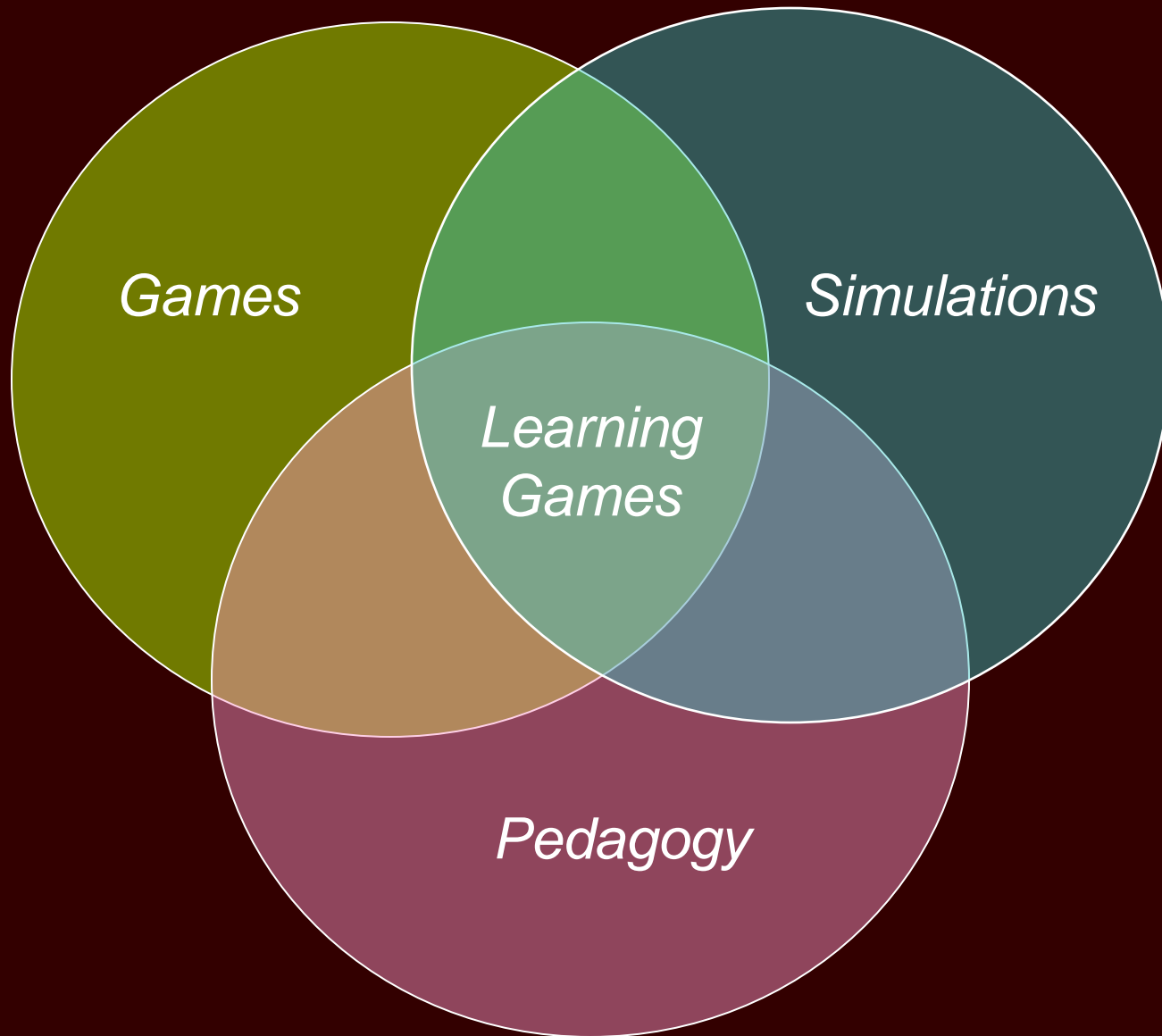*Elemental*
Hidden Agenda Games

The Binary Game
Cisco

Darfur is Dying
MTV-U

Fatworld
Persuasive Games

Background

A Case for Game-Based Learning
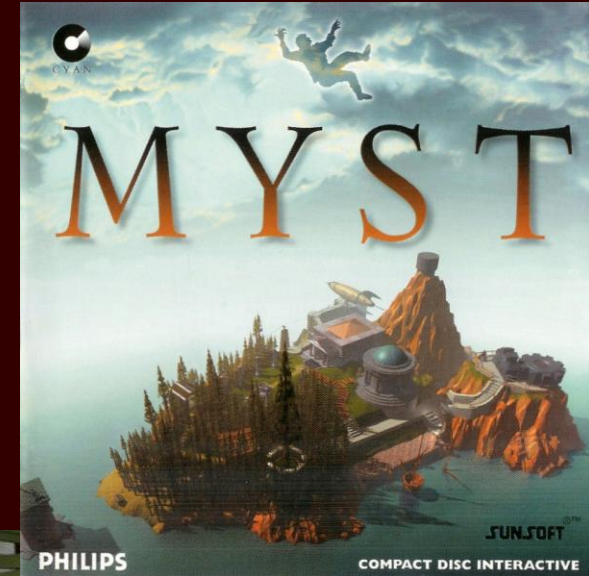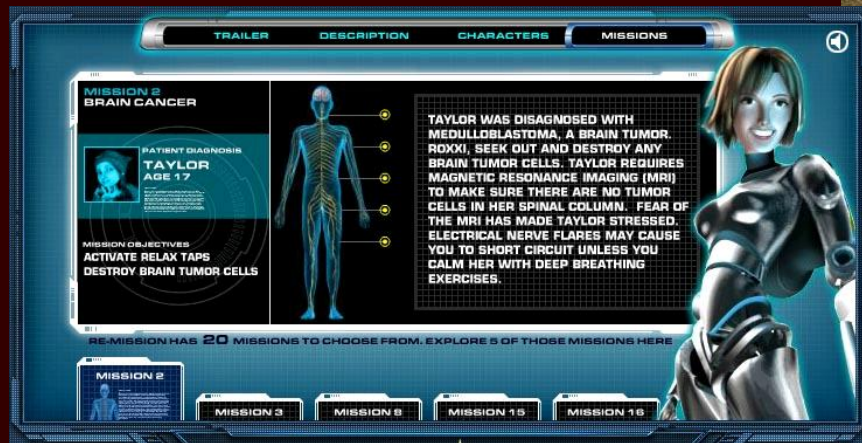
From the Science of Learning:

- Anchored Instruction/experiential learning

    - Situated learning

- Meaningfulness of material

- Authenticity/Fidelity

A Case for Game-Based Learning

From the Science of Learning:

- Compelling narrative

- Story

A Case for Game-Based Learning

From the Science of Learning:

- Active Participation

- Learner Control

A Case for Game-Based Learning
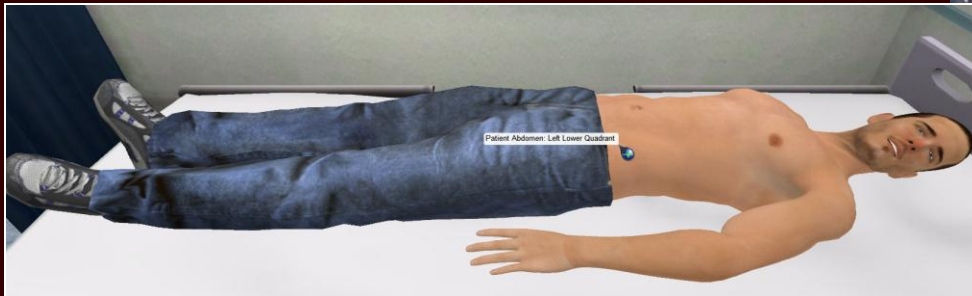
From the Science of Learning:

- Model-based Reasoning

- Metacognition

- Self-Regulation

A Case for Game-Based Learning

From the Science of Learning:

- Self-efficacy

- Goal Setting

- Intrinsic Motivation

A Case for Game-Based Learning

From the Science of Learning:

- ## Continuous Assessment

- ## Frequent Feedback

- ## Reward

A Case for Game-Based Learning

From the Science of Learning:

- Immersion/Engagement

- Emotional Context

- Embodiment

- Personalization

A Case for Game-Based Learning

From the Science of Learning:

- Collaborative Learning

- Social Status

- Vicarious Learning

- Coaching/Mentoring

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Why games *should* teach…

- Players learn **in context** by interacting with objects in a complex world.

- Consistent with **anchored, experiential learning,** learners can make connections among concepts
  - Players build sound **mental models** of a domain.

- Games are excellent **model-based** environments to foster complex reasoning.
  - Students observe system behavior over time; draw and test hypotheses.

- Games provide the players with **constant challenge**--many parallel achievements feed into an overriding goal.

- **Goals** are concrete and immediate.
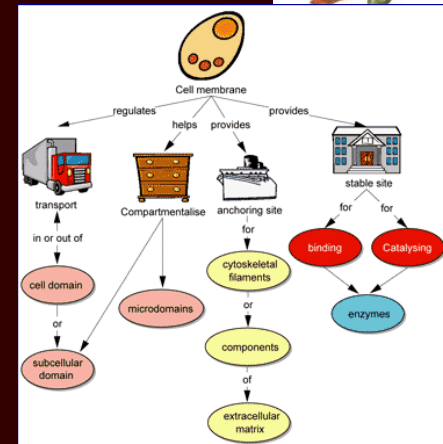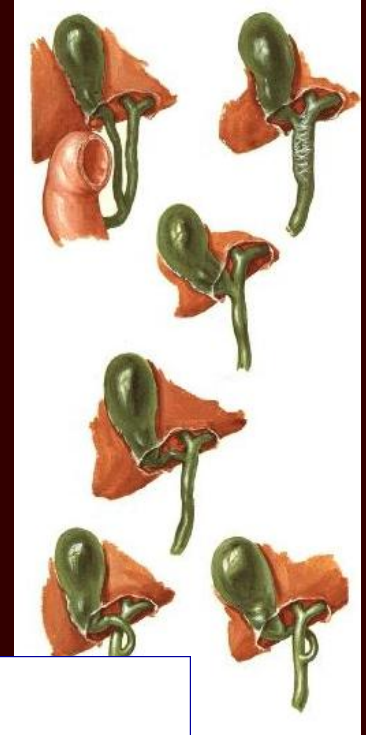
Why games *should* teach…

- Players negotiate successive, proximal goals—result is a feeling of **constant accomplishment.**
  - Likely to have a positive effect on **self-efficacy**.

- Games provide a **continuous source of assessment and feedback** so that players know where they stand with respect to their goal accomplishment.

- Game play is **self-regulating**.

- Players are **intrinsically motivated** to accomplish the next challenge and will readily acquire new knowledge as required to do it.
  - Moreover, mechanisms to track and plan **successive achievement** are often used (e.g., skill trees).
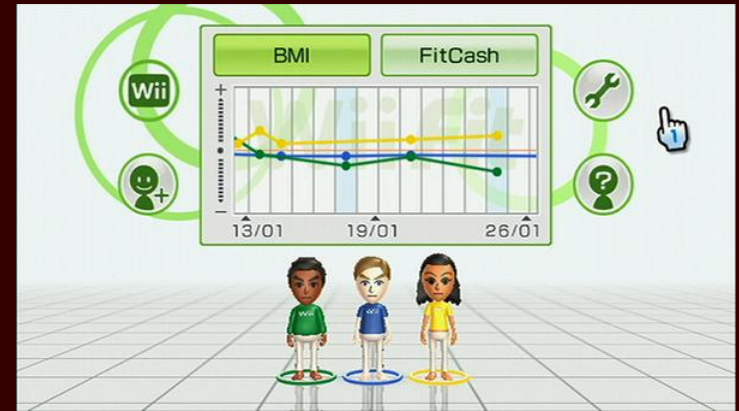
Why games *should* teach…

- Gaming is fundamentally a **social phenomenon**
  - It often results in distributed social groups that foster **collaborative learning** and resemble communities of practice.

- The **embodiment of the student** in the story enhances the players' sense of connection to the game
  - This enhances engagement.
  - **Personalization** of a player's avatar may do so as well.

- A player's accomplishments can easily be made public in a game format.
  - Such **public rewards** and recognition provide a **sense of competence, challenge and motivation** to achieve more.
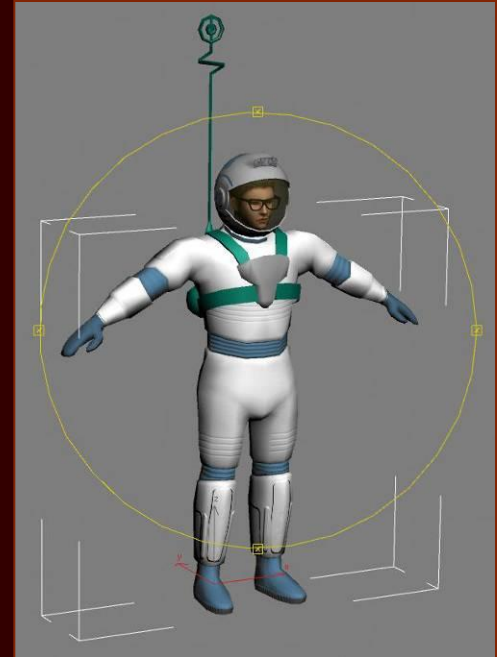
Driving Question
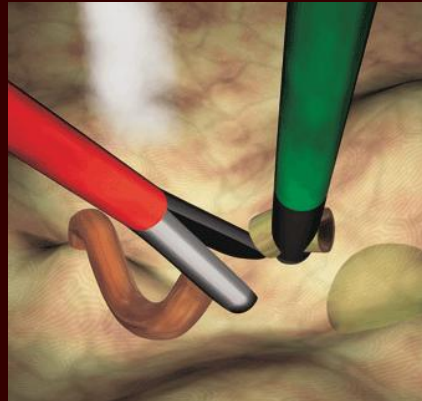
So, how should we build games that teach?
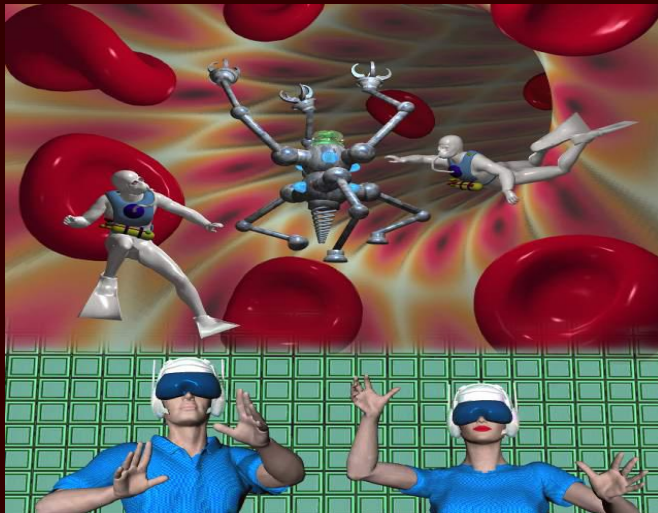
Incorporating the Science of Learning

- Include Domain/Subject Matter Experts on the team
- Include Learning experts on the team
- Make a deliberate attempt to incorporate sound learning principles:
    - Provide compelling narrative to enhance motivation
    - Provide compelling visuals to increase immersion
    - Embed learning into a meaningful context
    - Provide continuous feedback
    - Make goal accomplishment salient to foster metacognition, self regulation
    - Include public recognition and reward to enhance motivation
    - Incorporate collaborative learning

Exploit game features so that they teach!!

Challenges & Issues

- User Acceptance

- "Coolness"

- Cost

- Ease of Modification & Reuse

Challenges & Issues

User Acceptance:

- Sometimes using the term "game" is off-putting
- Collect empirical evidence of effectiveness
- Attempt to estimate ROI
- Work closely with targeted users
- Iterate based on user feedback
- Create adjuncts to traditional methods

Challenges & Issues

Ensuring "Coolness":

- Hire designers/developers who understand what makes games compelling
  - Hire "cool" people
- Involve users in all phases of design

IS IT FUN!?

Challenges & Issues

Containing Costs:

- Use low cost game engines
- Employ students for programming & graphics
  - Internships
- Consider "modding" an existing game
- Re-use content
  - Best done at asset level

Challenges & Issues

Enhancing Ease of Modification:

- Develop scenario generation tools
- Use game engines that allow easy mods
- Develop/adhere to standards (SCORM-like)
- Embed content into "mini games"
  - Lunar Quest Example

Example: Lunar Quest

- Funded by NSF

- Targeted at college-freshmen level Physics

- Adjunct to classroom

- Alternate Timeline: Retro 50s

Addressing the Challenges

Modification:

- Hybrid Approach
  - 3-D Massively Multiplayer On-line Game
  - 2D Flash-based Mini Games

- Learning content in "light weight" mini games
  - Cheap to create
  - Easy to modify
  - Enhances reuse of assets, scalability

- Modular Content
  - Scalable to multiple domains (e.g., chemistry, geology, social sciences) inside the same virtual world

Peter Smith (Producer) and Tim Holt (Designer) Present Lunar Quest at The Austin Game Developers Conference

Addressing the Challenges

Cost:

- Selection of Multiverse Engine (www.multiverse.net)
  - Profit share model (e.g., we don't pay)
- Hybrid MMO/minigame approach
  - Learning content embedded in light weight minigames
  - Minimizes degree of advanced coding in favor of Flash-based content
  - Can be done (well) by undergrads
- Use of off-the-shelf and student-created art assets

The Way Ahead

Research Issues:

- Enhanced assessment routines
  - Automated tracking
  - Dynamic assessment of performance
- Intelligent Tutoring
  - Draw inferences about mastery
  - Automatic feedback/remediation
- Establish a Science of Game-Based Learning
  - Which features are most important?
  - What provides the biggest bang for the buck?

The Way Ahead

- Game-based technologies hold great promise as teaching tools

- More empirical research is needed

- Mechanisms to share results are needed

- Better business models are sorely needed
  - Need to make compelling business case
  - May help encourage funding

- Ultimately, scientific studies must be translated into useful design guidance

Let the (Serious) Games Begin…